fuel injector **8912**, which may be an air-assist fuel injector such as a Delevan siphon nozzle, and a hot surface igniter **8914**. Also connected to the burner head **8903** are a first inlet **8916** and a second inlet **8918**. One of these inlets may be a liquid fuel inlet and the other inlet may be an atomizing inlet. A switch may be positioned between the first inlet **8916** and the second inlet **8918** so that when gaseous fuel is used, the gaseous fuel would flow through the second inlet **8918**, instead of the atomizer as described above. When liquid fuel is used, the switch would be configured such that liquid fuel would flow through the first inlet **8916** and atomizer would flow through the second inlet **8918**.

[0446] In a further embodiment of the burner, a blower may be coupled to burner **8900**.

Multiple Burner Multiple Piston Engine

[0447] Referring now to FIGS. **90** through **91**B, another embodiment is shown wherein each heater head **9002** of engine **9000** may be heated by an individual burner **9004**, as shown in FIG. **90**. Heater heads **9002** may be any of the various embodiments described in the preceding sections, including, but not limited to, tube heater heads, as designated by numeral **9116** in FIGS. **91**B-**91**D, or pin or fin heater heads, as designated by numeral **9118** in FIG. **91**A (and also shown as **5100** in FIGS. **53**D through **53**F). Burner **9004** may be any one of the various embodiments disclosed in the preceding sections and in U.S. Pat. No. 6,971,235.

[0448] Each burner **9004** includes a burner head **9100**. Similar to previous disclosed burner embodiments, the burner head **9100** has an igniter **9101**, a fuel injector **9108**, and a UV window (shown as **9107** in FIG. **91**B) for flame detection. Fuel passes through a first inlet **9106**, where it is heated by the igniter **9101** and formed into a flame. Preheated air, heated by the preheater **9102**, may be mixed with the fuel in the combustion chamber **9103**. The heated fuel mixture forms a flame inside the combustion chamber **9103** and heats the heater head **9002**. Any exhaust from the burner may exit the burner via an exhaust **9105**. In an alternative embodiment of the burner, an atomizer may be combined with the fuel via a second inlet **9110**. In another embodiment of the burner, a blower may be incorporated to maintain an average air ration amongst the individual burners **9004**.

[0449] Yet another embodiment may include a prechamber **9111**, as shown in FIG. **91**B. In this embodiment, the burner may include a combustion chamber **9103**, a prechamber **9111**, and a burner head **9100**. Combustion chambers **9103** may be positioned above the heater heads **9002**. A prechamber **9111** may connect the combustion chamber **9103** to a burner head **9100** via a prechamber nozzle **9112**, such as a simple nozzle, a swirler nozzle, or a pressure swirl nozzle. The burner head **9100** may house the UV window **9107** for flame detection, a fuel injection **9108**, which may be an air-assist fuel injector such as a Delevan siphon nozzle, and a hot surface igniter **9101**. Also connected to the burner head **9100** are a first inlet **9106** and a second inlet **9110**. One of these inlets may be a liquid fuel inlet and the other inlet may be an atomizing inlet.

[0450] The prechamber **9111** is a centrally located fuel preparation stage located upstream from the combustion chamber **9103**. The prechamber **9111** is where the fuel is ignited to form a diffusion flame. In one embodiment, where liquid fuel is used, the liquid fuel passes through the first inlet **9106**. Atomizer passes through the second inlet **9110** to atomize the liquid fuel and mix with the liquid fuel in the prechamber **9111**. As the atomizer and liquid fuel enter the prechamber **9111** via fuel injector **9108**, it is ignited by the hot surface igniter **9101**. Air may also pass through an intake and be preheated by a preheater **9102** before it travels into the prechamber **9111**, where it will mix with the atomizer and the liquid fuel. Once the mixture is preheated and formed into a diffusion flame, it travels through the prechamber nozzle **9112** into the combustion chamber **9103** to form a PPV (premixed prevaporized) flame. When the diffusion flame leaves the prechamber **9111**, evaporation may occur in the prechamber **9111** which may allow the diffusion flame to be relit more easily, should it get flamed out or burned out.

[0451] Once the flame is in the combustion chamber **9103**, the heat from the flame is used to heat the heater heads **9002**. The heated gas from the combustion chamber **9103** evenly flows over the surface of each of the heater heads **9002**, wherein heater heads **9002** transfer the heat contained in the heated gas to a working fluid contained in the working space of the engine (shown as **9000** in FIG. **90**). The combustion chamber **9103** may have apertures (shown as **9114** in FIG. **91**A) in its surface to further assist in distributing the PPV flame evenly across each of the heater heads **8804**.

[0452] The principles of the present invention may be applied to all types of engines, include Stirling engines, and may be applied to other piston machines utilizing cylinders such as internal combustion engines, compressors, and refrigerators. However, the present invention may not be limited to the double-acting four-cylinder Stirling engine.

[0453] While the principles of the invention have been described herein, it is to be understood by those skilled in the art that this description is made only by way of example and not as a limitation as to the scope of the invention. Other embodiments are contemplated within the scope of the present invention in addition to the exemplary embodiments shown and described herein. Modifications and substitutions by one of ordinary skill in the art are considered to be within the scope of the present invention.

What is claimed is:

1. An reciprocating machine comprising:

a first region comprising a first fluid and two or more reciprocating pistons, the first fluid having a first pressure that oscillates about a mean pressure;

a second region comprising a second fluid and a drive, the second fluid having a second pressure

two or more coupling assemblies mechanically connecting the drive to the two or more reciprocating pistons;

an airlock separating the first region from the second region, the airlock containing the first fluid at a third pressure, the airlock being imperfectly sealed from the first region, and the two or more coupling assemblies pass through the airlock;

two or more rolling diaphragm seals sealing the first fluid in the airlock from the second fluid, each rolling diaphragms being connected to one of the two or more coupling assemblies and comprising elastomeric material with fibers dispersed therein; and

an airlock pressure regulator fluidicly connected to the airlock, the airlock pressure regulator configured to maintain a predetermined pressure differential between the second pressure and the third pressure.